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ABSTRACT

Student interaction and computer-based communication tool appropriation patterns were examined in two different communication assignments requiring active use of computer-based communication tools. University students completed either: a set of communication assignments and activities with the instructor as sole audience; or a set of communication assignments and activities requiring discussion among students as the primary audience. Two cases were used to explore the communication context--the format of communication exchange and the timing of the communicative interaction. The interactions were coded along several dimensions including social communication, aggressive/destructive communication and closed versus open-ended communication. The results show that the communication content was relatively free of flaming (i.e., destructive communication), the format of the communication exchange closely mirrored the assignments, and a significant (30%) proportion of the communication took place outside of the "normal" 8 to 5 timeframe. These results suggest that instructor worries about excessive flaming are unwarranted. Further, they indicate that instructors must carefully consider the outcome they desire from the technology to be sure the assignments will lead to those outcomes. Finally, the results indicate that students do appropriate the technology at varying times, resulting in an expanded classroom space. (Contains 57 references.) (Author/AEF)

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ED 422 955

AN EXAMINATION OF THE CHARACTERISTICS OF STUDENT INTERACTION IN COMPUTER-BASED COMMUNICATION ASSIGNMENTS

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Student interaction and computer-based communication tool appropriation patterns were examined in two different communication assignments requiring active use of computer-based communication tools. University students completed either: (a) a set of communication assignments and activities with the instructor as sole audience; or (b) a set of communication assignments and activities requiring discussion among students as the primary audience. Two cases were used to explore the communication content, the format of communication exchange, and the timing of the communicative interaction. The interactions were coded along several dimensions including social communication, aggressive/destructive communication, and closed versus open ended communication. The results show that the communication content was relatively free of flaming (i.e., destructive communication), the format of the communication exchange closely mirrored the assignments, and a significant (30%) proportion of the communication took place outside of the "normal" 8 to 5 timeframe. These results suggest that instructor worries about excessive flaming are unwarranted. Further, they indicate that instructors must carefully consider the outcome they desire from the technology to be sure the assignments will lead to those outcomes. Finally, the results indicate that students do appropriate the technology at varying times, resulting in an expanded classroom space.

INTRODUCTION

Today's educators face innumerable pressures to provide quality instruction within the market constraints of increasing class sizes, increasing customer demands for flexible course scheduling, and an increasing age profile of students (i.e., more adult learners outside the traditional 18-22 year-old range). Computer-based communication tools (CBCTs) are frequently touted as a low-cost and effective means to this end, especially in the case of distance education programs (Berge & Collins, 1995; Garrison, 1990; Huang, 1996-97; Lyons, 1995; Santoro & Phillips, 1994; Wells, 1992). CBCTs are communication technologies that include electronic mail discussion groups, conferences and/or chat rooms, and dynamic material repositories such as web pages and shared databases (Harasim, 1990; Hiltz, 1994; Rice & Associates, 1984; Santoro, 1994, 1995; Sproull & Kiesler, 1992). A central feature of these tools is the support of communication tasks -- specifically the enabling of person-to-person (or person-to-many persons) interaction across space and time constraints such as those normally imposed by a physical classroom (Harasim, Hiltz, Teles, Turoff, 1995; Hiltz, 1994). Although researchers and educators have investigated the utility of these approaches as instructional delivery mechanisms (Berge & Collins, 1995; Hiltz, 1986, 1990; Huang, 1996-97; Wells, 1992), the examination of student interaction patterns during CBCT usage for pedagogical purposes (such as active learning) is a relatively new empirical topic.

CBCTs provide opportunities for instructors to expose students to knowledge, as well as

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opportunities for students to build their own knowledge through interaction via an electronic communications medium (Corporation for Public Broadcasting, 1994; Garrison, 1990; Harasim et al., 1995; Hiltz, 1994; Price, 1996; Salomon, 1991). The exposure to and development of student knowledge transpires as a function of the dynamic interaction process within the learning environment (Angelo, 1993; Cross, 1987; Johnson & Johnson, 1994; Wang, Haertel, Walberg, 1993). Thus, usage of CBCTs may promote active learning of course material by engaging the student in communication activities and behaviors that stress interaction among students and between the student and the instructor(s). However, students must individually appropriate and use the CBCT in a manner that supports effective interaction in order to gain such benefits (Collins, 1996-97; Harasim, 1993; Hiltz, 1994; Kaye, 1992; McComb, 1994; Santoro & Phillips, 1994; Vician & Nickles, in press). Factors that can significantly influence the effectiveness of student interaction include the communication message **content,** the communication exchange **format,** and the communication exchange **timing** (Bormann, 1989; Daly, Friedrich, and Vangelisti, 1990; Lowry, Koneman, Osman-Jouchoux, & Wilson, 1994; Phillips & Santoro, 1989; Santoro & Phillips, 1994; Shedletsky, 1993).

Examining the characteristics of student interaction within CBCT usage is key to forming an understanding of CBCT appropriation patterns, and ultimately discovering factors that may influence student learning outcomes. To examine the characteristics of student interaction and CBCT appropriation behaviors involved in completing computer-based communication assignments, we employ a case study methodology. Specifically, we focus on three key dimensions: (1) the communication content, (2) the communication exchange format (i.e., the extent to which threaded discussions are conducted versus more question-and-answer dialogues), and (3) the communication exchange timing (e.g., the degree to which students use the technology to extend the boundaries of the classroom by using the CBCT beyond "normal" hours). This study is a descriptive inquiry within our larger quest to understand the potential influence of CBCTs in student learning experiences. Our research efforts are focused on the following overall question: What kinds of student interaction and CBCT appropriation patterns occur when students are asked to complete computer-based communication assignments?

The remainder of this paper is organized as follows. We first present our research framework, followed by a description of our methodology, and our analytic approach for this study. We then present the results, followed by a discussion of the theoretical and practical implications of differences in student interaction and CBCT appropriation patterns. The paper concludes with suggestions for future research.

RESEARCH FRAMEWORK

Our research framework is grounded in communication theories of interpersonal and small group interaction (Bormann, 1989, 1990; Brammer, 1993; Daly et al., 1990), research on computer-mediated communication and electronic mail (Culnan & Markus, 1987; Garton & Wellman, 1995; Markus, 1994a, 1994b; Rice & Associates, 1984; Sproull & Kiesler, 1992; Walther, 1996), educational theories of learning and instructional design (Angelo, 1993; Astin, 1993; Cross, 1987; Gagnae & Briggs, 1974; Johnson & Johnson, 1994; Martin & Briggs, 1986; Sadker & Sadker, 1992; Salomon, 1991; Wang et al., 1993) and research on cyberspace, distance, online, and virtual learning environments (Harasim, 1990; Hiltz, 1994; Hiltz & Turoff, 1993; Kaye, 1992; McComb, 1994; Phillips & Santoro, 1989; Santoro, 1995; Wells, 1992). Figure 1 presents our overall framework resulting from a synthesis of prior research and theory; Figure 2 provides a specific model of the variables of interest in this study. The remainder of this section will describe the relevant components of Figure 2.

FIGURE 1

RESEARCH FRAMEWORK

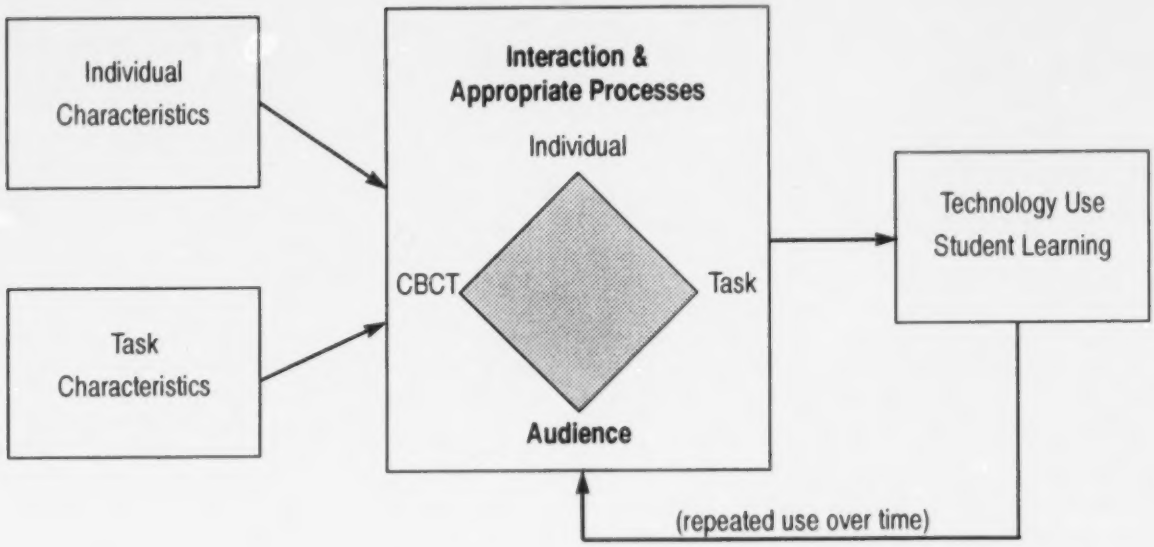
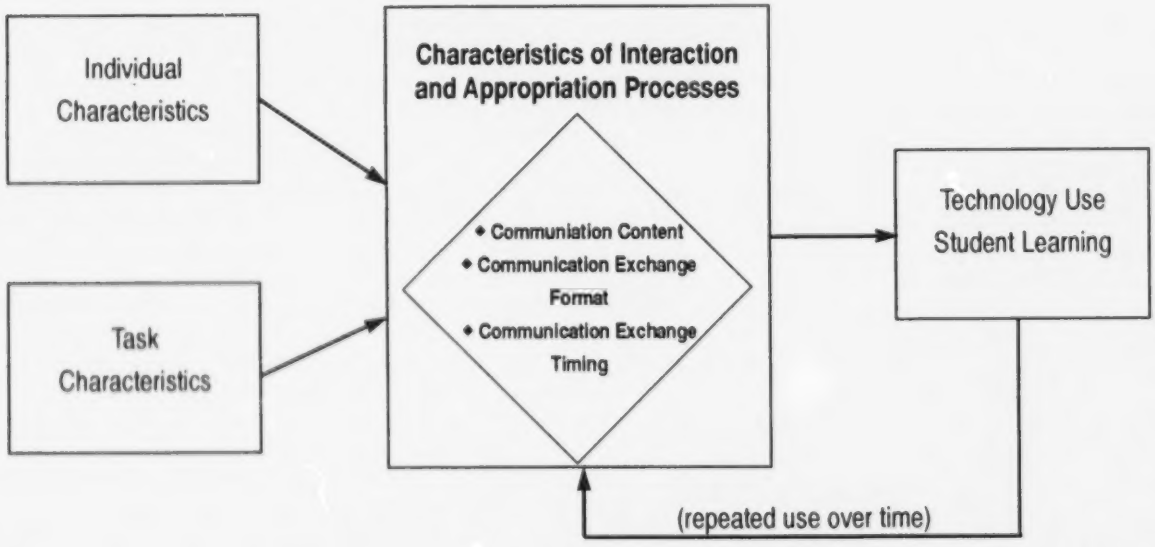


FIGURE 2

SPECIFIC RESEARCH MODEL APPLIED TO STUDENT INTERACTION AND APPROPRIATION PROCESSES



Communication Content

In a classroom setting, the communication content can be influenced directly and immediately by the dynamic discussion of other communication partners who are also present at the same-time and same-place. In addition, the presence of the instructor is likely to have an influence on the content and tone of the classroom communication. In a computer-based environment, however, the influence of other individuals can be less obvious and less immediate (Finholt & Sproull, 1990; Garton & Wellman, 1995; Markus, 1994b; Sproull & Kiesler, 1986). Some instructors worry that students might engage in inappropriate behavior, such as flaming (Kiesler, Siegel, and McGuire, 1984; Sproull & Kiesler, 1986). This could make the computer-based environment uncomfortable for some students, and actually lead them to avoid using the system. On the other hand, students might engage in more personal exchanges of information (Vavarek and Saunders, 1993-1994; Walther, 1996) that could facilitate relationship building with the instructor or other students (Johnson, 1981; Johnson & Johnson, 1994; Wang et al., 1993), and could lead to a more positive perspective of the educational experience (Collins, 1996-97; Harasim, 1993; Hiltz, 1994; Martin & Briggs, 1986; McComb, 1994).

Communication Exchange Format

Classroom interaction can take a variety of forms, such as question-and-answer or extended discussion. This is also true of computer-based interaction. But, the extent to which either interaction pattern is prevalent depends on how the students appropriate the technology (Hiltz, 1986; Hiltz, 1990; Levin, Kim, & Riel, 1990; Markus, 1994b; Philips and Santoro, 1989). Even in situations where the goal is to have a discussion, student interaction may take the form of a question and answer format. On the other hand, students might use the technology to obtain feedback or engage in problem-solving behavior, and thus extend their use of the technology beyond the task demands (or implicit instructors' goals).

The format of the communication exchange also has significant bearing on the depth of social interaction possible for individuals in the communication exchange (Bormann, 1989; Daly et al., 1990). Educational research argues that social interaction is integral to the development and refinement of knowledge, especially for adult learners (Johnson & Johnson, 1994; Martin & Briggs, 1986). Further, social interaction is central to the facilitation of collaborative and active learning activities (Angelo, 1993; Brufee, 1984; Cross, 1987; Pence, 1996-97). CBCTs have been found useful in supporting the social interaction of learning processes in the college classroom (Harasim et al., 1995; Hiltz, 1994; Hiltz & Turoff, 1993). However, it is important to examine the actual communication exchange format that results after student appropriation of the CBCT in order to assess the depth of interaction achieved by the students.

Communication Exchange Timing

Classrooms are constrained by time and space. With the current trend toward increased class sizes (Weimer, 1987), per-student air time has decreased substantially. CBCTs, and especially electronic mail, can transcend the space and time constraints of the physical classroom by providing students with seven-day-a-week, 24-hour access to communication exchange opportunities. The asynchronous nature of electronic mail, in particular, allows an individual substantial control over when messages are sent or received. Use of a CBCT in support of class objectives provides maximum scheduling flexibility in an individual's work-day and can change the nature of per-student air time in the class. Thus, the use of CBCTs can augment classroom air time, both in terms of quantity and in terms of student availability.

Additionally, educational research suggests that student-student interaction and student-instructor interaction are critical to student satisfaction with and success in the education process (Astin, 1993; Johnson, 1981). Hiltz (1994) provides self-report data indicating that increased access to the instructor was a highly rated attribute of using a specialized CBCT in college courses. CBCTs can provide additional opportunities for such interaction, especially if students use the tools at times beyond the boundaries of scheduled class meeting times. It is important to examine the timing dimension of interaction to gain a better understanding of how students actually exercise their communication timing opportunities.

METHODOLOGY

Overview

Computer-based communication was monitored over the course of a ten-week quarter, in two courses offered to different student populations at a large midwestern university. The courses were selected based on the following criteria: (1) students were required to use the technology to complete course assignments; (2) there was some variation in the assignments across the courses (but not within the courses); and (3) the technology was a pedagogical resource, rather than the object of instruction. Thus, this study employs both literal and theoretical replication (Yin, 1989); we expect similar results along some dimensions (e.g., timing) and different results along others (e.g., exchange format, content).

Subjects

A total of forty-eight undergraduate students (20 in the first course and 28 in the second course) enrolled in two communication courses in different colleges at the same large midwestern university participated in this study. The courses were taught during the same academic year covering a 10-week term. Students participating in the study received course credit toward their final grade.

Task

In course #1 (C1), students were required to submit answers to essay questions directly to the instructor. The submissions had to be sent via the university's electronic mail system (Pine Mailer). In course #2 (C2), students were assigned to conversation groups and required to discuss questions posed by the instructor, also using the university's electronic mail system. Students in C2 sent messages to their group using a distribution list. The instructor was included as a member of the distribution list, but did not participate in the discussion.

Procedures

The instructors of both classes provided a basic introduction to the computer-based communication assignments for each course at the beginning of the academic term and indicated that the instructor could be contacted if students encountered problems with using the CBCT. Further, the instructor for C2 provided an initial electronic mail training session in a university lab as less than twenty percent of the course members had previous electronic mail experience. Additionally, both instructors collected electronic mail messages sent to their mailboxes throughout the quarter.

Measures

Similar to coding techniques used by Poole (1983) and Poole, Holmes, Watson, and DeSanctis (1993), an interaction coding scheme was derived from prior research and used to analyze the content of electronic mail messages. In essence, the coding scheme was designed to assess the characteristics of interest: communication content, communication exchange format, and communication exchange timing.

Each message was separated into turns and coded using the coding scheme developed for this study (see Table 1). A turn represents a distinct topic within a message. Thus, a message can contain one or more turns. There were 207 turns for C1 and 158 turns for C2.

DATA ANALYSIS AND DISCUSSION

The communication messages were printed in hard-copy format and coded according to the method defined above. Two individuals, not the course instructors, coded the data set. A subset of the messages was used to train and co-orient the coders. Following training, these messages were returned to the total data set. Both coders coded all messages and came to consensus on interpretation. Preconsensus agreement of the coders on C1 was 93% and on C2 was 95%. All disagreements were resolved, with coder 1 changing to coder 2's interpretation 42% of the time for C1 and 44% of the time for C2. Coder 2 changed to coder 1's interpretation 58% of the time for C1 and 56% of the time for C2. Coefficients of inter-rater reliability were not calculated for this study due to its exploratory nature.

A total of 214 messages were collected for C1; 160 messages were collected for C2. Some messages were duplications, for example if a student thought a message did not get through, he or she might send it two or three times, just in case. This resulted in a total of 324 valid messages. Descriptive statistics for the dataset are provided in Table 2.

TABLE 1

CODING SCHEME

Construct	Variable	Definition
Communication Exchange timing	Date/Time	Date and Time the message was sent
Communication Exchange format	Topic Continuation	Indicates if this turn continues a topic from a previous message (0=initates; 1=continues a topic begun electronically; 2= continues a topic begun in class).
	Resolution	Indicates if the topic is one that will lead to resolution, such as question and answer format (1) or not, such as questions aimed at eliciting ongoing discussion (2).
Communication Content	Subject type	Indicates if the content of the turn is social (1), housekeeping (2), or relating to substantive course content (3).
	Destructive communication	Indicates if the turn contains characteristics of inappropriate interaction (e.g., flaming) (1) or not (2).
	Private communication	Does the turn indicate that the person desires that this information not be shared? (1=private, 2=not private).
	Sharing	Does the turn demonstrate a desire to establish and/or build a personal (vs. professional) relationship as evidenced through self-disclosure? (1=yes, 2=no)

TABLE 2

DESCRIPTIVE STATISTICS

	Case #1 (C1)	Case #2 (C2)
Assignment	Answers to essay questions were submitted directly to the instructor via electronic mail	Students assigned to conversation groups and required to discuss questions posed by the instructor, using the university's electronic mail system.
Role of Instructor	Active (Receiver and Sender)	Passive (Receiver)
Number of Messages	214	160
Number of Valid Messages	194	130
Number of Turns	207	158

Communication Content

The variables of subject type, destructive communication, private communication, and sharing were used to assess communication content (see Table 3). Substantive course content was the focus of the majority of turns in both courses. Surprisingly, only 6% of the communication incidents were regarding social topics. However, there is evidence that use of the computer-based communication tool did not impede student self-disclosure activities (sharing) as 32% of the turns in C2 and 16% of the turns in C1 evidenced such communication content. This suggests that the computer-based medium is not seen **primarily** as an arena to build relationships among students or between student and instructor, though our evidence demonstrates a noticeable level of sharing does occur.

With regard to destructive communication, the majority of communication incidents were found to be free of flaming and other aggressive communication. Where negative comments existed, they were typically aimed at the technology. Thus, this suggests that instructors need not worry about excessive flaming, at least when they are virtually present in the interaction.

Finally, there were very few communication incidents in which the student expressed a desire to keep the content private. As expected, there were more private communications in C1 where the interaction was typically student to instructor, rather than student to students as in C2. This suggests that the potential exists to use CBCTs as a substitution for face-to-face office hours. However, the students may not have realized the ease with which a message can be forwarded (accidentally or purposefully), and thus may not have assumed privacy without requesting it.

TABLE 3

ANALYSIS OF COMMUNICATION CONTENT

	C1 (Questions and Answers)	C2 (Group Discussions)
Subject type:		
course content	135 (65%)	123 (78%)
social	1 (6%)	1 (6%)
course "housekeeping"	60 (29%)	25 (16%)
Destructive	4 (2%)	8 (5%)
Private	32 (15%)	4 (2.5%)
Sharing	34 (16%)	50 (32%)

TABLE 4

ANALYSIS OF COMMUNICATION EXCHANGE FORMAT

	C1 (Questions and Answers)	C2 (Group Discussions)
Resolution		
Move to resolve	193 (93.2%)	37 (23.4%)
Open ended	14 (6.8%)	121 (76.6%)
Topic Continutation:		
Computer-based	141 (68%)	96 (60%)
Class	39 (19%)	31 (20%)
Initiation of a topic	27 (13%)	31 (20%)

TABLE 5

COMMUNICATION EXCHANGE TIMING ANALYSIS

	C1 (Questions and Answers)	C2 (Group Discussions)
Turns outside "normal" hours	61 (29.5%)	59 (37.3%)

Communication Exchange Format

The variables of topic continuation and resolution were used to assess communication exchange format (see Table 4). Overwhelmingly, the coded communication incidents showed that student interaction mirrored the requirements of the task assignments. In other words, question-and-answer (move to resolve) was the focus in the first class, and extended discussions (open-ended) were the focus in the second class. There were, however, many references to previous computer-based messages, as opposed to class discussions. These results suggest that students view the computer-based communication forum as a distinct and separate discussion arena, one with its own topics and purposes.

Communication Exchange Timing

Finally, the time stamps of messages were used to assess the times during which communication occurred (see Table 5). Our analysis supports the idea that students use the CBCT to communicate beyond the boundaries of a "normal" 8 to 5 day.

Summary

The results suggest that computer-based communication does not have an unusually large incidence of aggressive communication, at least when the instructor is "present." Approximately one-third of the communication incidents were at times beyond the "normal" hours of 8am to 5pm, suggesting that students used the technology to extend the classroom boundaries to times that were appropriate for them. Finally, the results suggest that instructors must be careful to match assignments to goals for using the technology. In other words, simply assigning use of the technology as a class requirement may not meet the goals of increasing student-student and student-instructor interaction.

CONCLUSION

Practical implications

This study provides two major practical insights about student interaction in computer-based communication assignments. First, the frequency and rate of student use of the CBCT can be influenced by instructor responsiveness over the same computer-based communication medium. Instructors need to recognize the importance of taking time to promptly respond to student messages, whether the message content is assignment-specific or not. The actual impact on instructor time/workload depends on the nature of the computer-based communication assignment (Vician & Brown, 1996; Vician & Nickles, in press). However, if the assignment is such that the computer-based communication form replaces the paper form, then the additional time needed is incremental, as in the cases presented here. The key for the instructor of C1 was to respond to messages in a timely manner so that students would continue to appropriate the technology and use it beyond the original computer-based submission. For C2, the use of the CBCT meant that discussions could be tracked more effectively since the instructor retained a copy of all messages. Second, instructors must be careful to match assignments to goals for using the CBCT in a course. If increased interaction is a goal, instructors may need to model technology usage behavior that encourages student to student and/or student to instructor interaction. Further, instructors may need to develop feedback or mid-course intervention methods to adjust interaction levels.

Research implications

This study has several implications for research, many of which are in the form of directions for future research. First, the results suggest the

need to match assignments to goals for technology use. This leads us to ask if some combinations are better than others. Further research is needed to determine how the combinations influence student learning. Second, the results suggest that individual and task characteristics might interact to influence interaction, appropriation processes, and student outcomes. This leads us to ask what are the theoretical relationships among individual characteristics, task characteristics, interaction and appropriation processes, and student outcomes (technology use, student learning). Finally, the results raise questions about the extent to which social interaction and relationship building can occur within a learning process dependent upon computer-based communication tools (e.g., distance learning). Educational research suggests that student-student and student-instructor relationships associated with traditional classroom interaction are key to a positive educational experience, and often learning outcomes. Whether or not the student-student and student-instructor relationships will retain primacy in a student's educational experience in the presence of CBCT usage is an empirical question for future investigation.

Summary

This study provides an initial examination of the characteristics of student interaction in a computer-based communication environment, and is part of our larger research stream investigating the influx of computer-based communication technologies into educational settings. This study's results suggest that CBCTs have potential to augment classroom interaction and, perhaps more importantly, to influence student learning experiences and outcomes. Future research is necessary to examine the relationship between student learning outcomes and types of computer-based communication tools, as well as types of computer-based communication assignments. Additionally, research is necessary to determine the boundaries of effective communication in computer-based environments and the influence of computer-based communication activities on a student's general level of communication skills. Finally, and perhaps most importantly, more research is necessary to identify the key aspects of a theory of computer-based communication and student learning.

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